इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 14663 (1999): Manipulating industrial robots - Coordinate systems and motions [PGD 18: Industrial and Production Automation Systems and Robotics]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA
JURIS
NON EXCUSAT

PROTECTED BY COPYRIGHT

IS 14663 : 1999
ISO 9787 : 1990

(Reaffirmed 2005)

भारतीय मानक

औद्योगिक रोबॉट संचालन – समन्वय पद्धतियाँ और चाल

Indian Standard

MANIPULATING INDUSTRIAL ROBOTS — COORDINATE SYSTEMS AND MOTIONS

ICS 25.040.30

© BIS 1999

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 1999

Price Group 3

Industrial and Production Automation Systems and Robotics Sectional Committee, PE 18

NATIONAL FOREWORD

This Indian Standard which is identical with ISO 9787 : 1990 'Manipulating industrial robots — Coordinate systems and motions', issued by the International Organization for Standardization (ISO), was adopted by the Bureau of Indian Standards on the recommendations of the Industrial and Production Automation Systems and Robotics Sectional Committee and approval of the Production Engineering Division Council.

The text of the ISO Standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

Indian Standard

MANIPULATING INDUSTRIAL ROBOTS — COORDINATE SYSTEMS AND MOTIONS

1 Scope

This International Standard defines and specifies three robot coordinate systems; it also gives the axis nomenclature. It is intended to aid in robot alignment, testing, and programming.

This International Standard applies to all manipulating industrial robots as defined in ISO/TR 8373.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/TR 8373:1988, *Manipulating industrial robots – Vocabulary*.

3 Definitions

For the purposes of this International Standard, the definitions given in ISO/TR 8373 apply.

4 Defined coordinate systems

All coordinate systems described in this International Standard are defined by the right-hand rule as shown in figure 1.

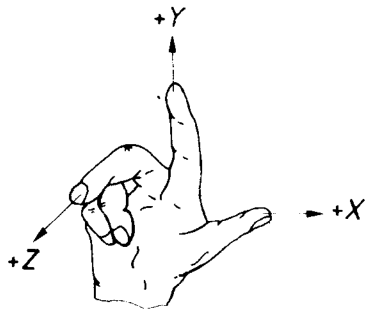

Figure 1 — Right-hand coordinate system

A, B and C define rotary motions about axes respectively parallel to X, Y and Z.

Positive A, B and C are in the directions to advance right-hand screws in the positive X, Y and Z directions respectively (see figure 2).

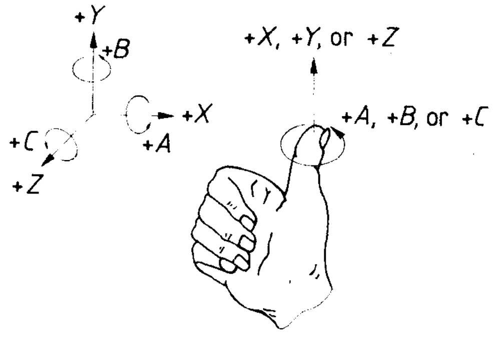

Figure 2 — Rotary motions

The three coordinate systems described are the World, Base, and Mechanical Interface, each referring to the plane in which the X-Y axes lie (e.g. the X-Y axes of the base coordinate system lie in the plane of the base mounting surface). The Z axis is perpendicular to the X-Y plane. Figure 3 shows an example of the three coordinate systems described in this International Standard.

Although this International Standard defines only three coordinate systems, others may be defined.

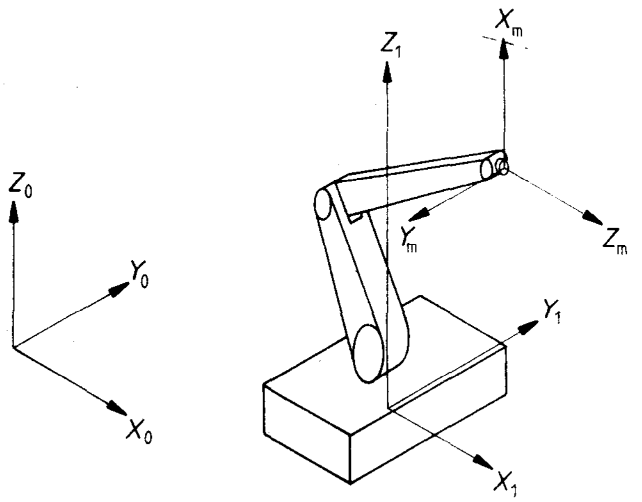

Figure 3 — Coordinate systems

5 World coordinate system

5.1 Notation

$X_0 - Y_0 - Z_0$

5.2 Origin

The origin of the world coordinate system is to be defined by the users according to their requirements.

5.3 $+Z_0$ axis

The $+Z_0$ axis is colinear but in the opposite direction to the acceleration of gravity vector.

5.4 $+X_0$ axis

The $+X_0$ axis is to be defined by the users according to their requirements.

6 Base coordinate system

6.1 Notation

$X_1 - Y_1 - Z_1$

6.2 Origin

The origin shall be defined by the manufacturer of the robot.

6.3 $+Z_1$ axis

The $+Z_1$ axis is in the direction of the mechanical structure of the robot pointing away from the base mounting surface.

6.4 $+X_1$ axis

The $+X_1$ axis points away from the origin and passes through the projection of the centre point of the robot working space, C_w, on to the plane of the base mounting surface (see figure 4). When the robot configuration precludes this convention, the direction of the $+X_1$ axis shall be defined by the manufacturer.

NOTE 1 Examples of the application of the base and mechanical interface coordinate systems are found in annex A.

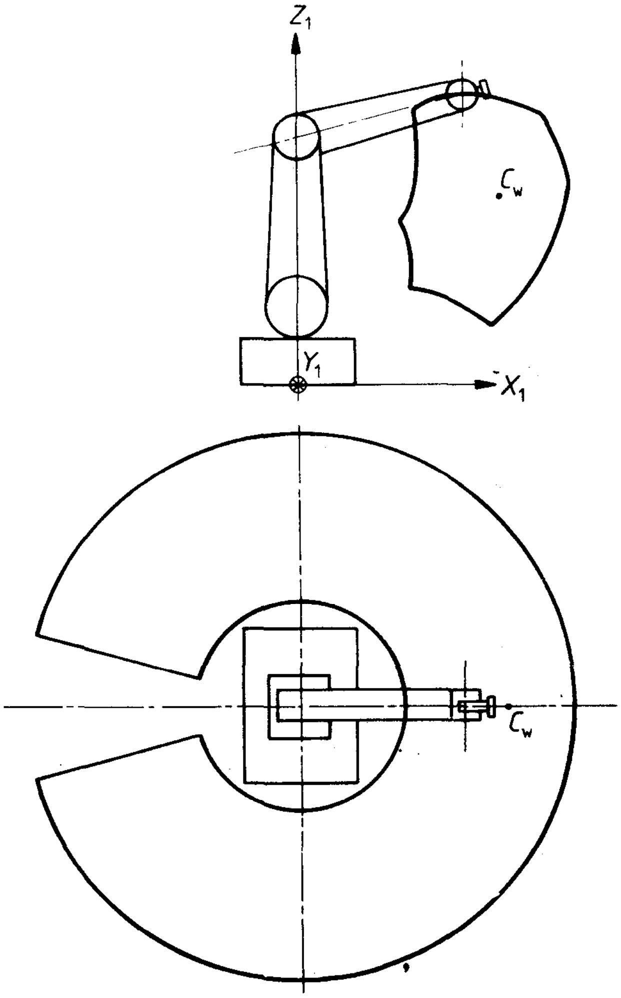

Figure 4 — Example of robot working space

7 Mechanical interface coordinate system

7.1 Notation

$X_m - Y_m - Z_m$ (m = number of robot axes (n) +1)

7.2 Origin

The origin is the centre of the mechanical interface.

7.3 $+Z_m$ axis

The $+Z_m$ axis points away from the mechanical interface toward the end effector.

7.4 $+X_m$ axis

The $+X_m$ axis is defined by the intersection of the plane of the mechanical interface and the plane X_1 Z_1 (or a plane parallel to X_1 Z_1) such that the origin of the mechanical interface coordinate system lies on the line of intersection, with the robot primary and secondary axes in their mid-positions. When the robot configuration precludes this convention, the position of the primary axes shall be defined by the manufacturer. The $+X_m$ axis points away from the Z_1 axis. In the case where Z_1 and X_m are parallel, the $+X_m$ axis is in the same direction as the $+Z_1$ axis.

NOTE 2 Examples of the application of the base and mechanical interface coordinate systems are found in annex A.

8 Robot motions

8.1 Linear motions

When linear motions of the end effector are defined in the base coordinate system, they are designated by the following directions:

+ or $-x$ along or parallel to the X_1 axis,

+ or $-y$ along or parallel to the Y_1 axis;

+ or $-z$ along or parallel to the Z_1 axis.

8.2 Rotary motions

Under consideration.

9 Robot axis nomenclature

If the axes are numerically designated, axis 1 shall be the first motion closest to the base mounting surface, axis 2 the second motion, and so on, and axis n the motion to which the mechanical interface is attached.

NOTE 3 Examples of robot axis nomenclature are found in annex A.

Annex A
(informative)

Examples of application for different mechanical structures

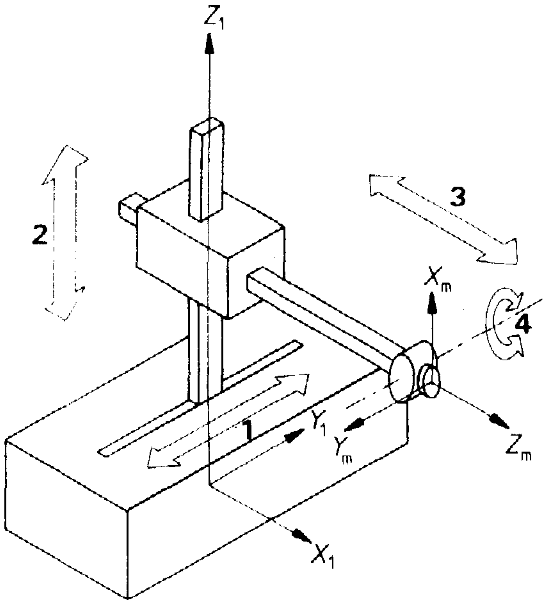

Figure A.1 — Rectangular robot

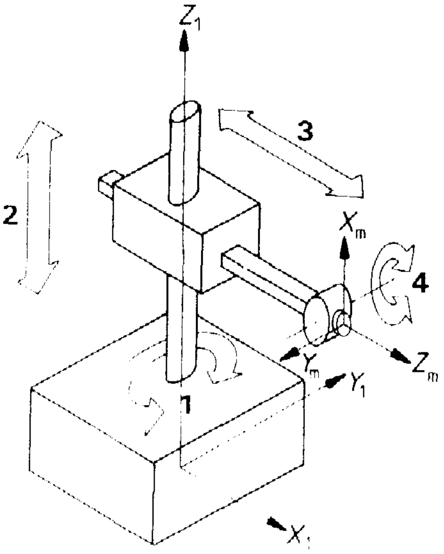

Figure A.2 — Cylindrical robot

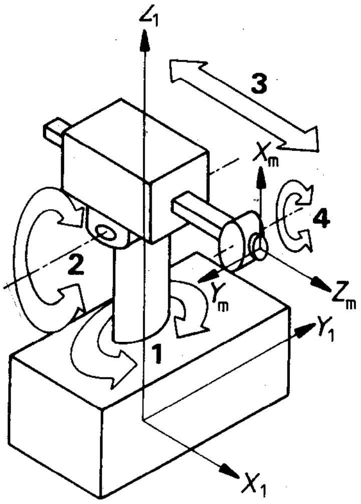

Figure A.3 — Polar robot

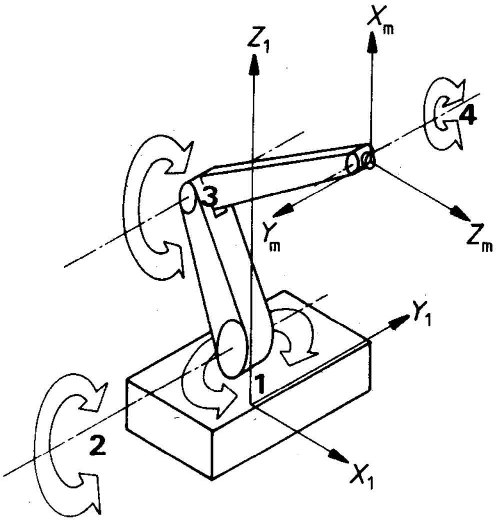

Figure A.4 — Revolute robot

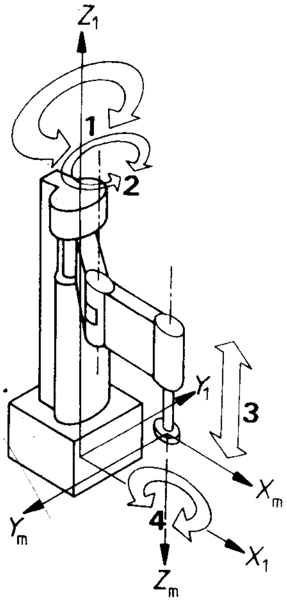

Figure A.5 — Polar robot

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that.changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. PE 18 (0215).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :

	Address	Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110 002	323 76 17 323 38 41
Eastern	: 1/14 C. I. T. Scheme VII M, V. I. P. Road, Kankurgachi CALCUTTA 700 054	337 84 99, 337 85 61 337 86 26, 337 91 20
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 160 022	60 38 43 60 20 25
Southern	: C. I. T. Campus, IV Cross Road, CHENNAI 600 113	235 02 16, 235 04 42 235 15 19, 235 23 15
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400 093	832 92 95, 832 78 58 832 78 91, 832 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM.

Printed at Printograph, New Delh, Ph.: 5726847